
GCSE

Methods in Mathematics

93651F: Foundation Tier

Mark scheme

9365

June 2016

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. eg, accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
3.14 ...	Allow answers which begin 3.14 eg 3.14, 3.142, 3.149.
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a candidate has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the candidate. In cases where there is no doubt that the answer has come from incorrect working then the candidate should be penalised.

Questions which ask candidates to show working

Instructions on marking will be given but usually marks are not awarded to candidates who show no working.

Questions which do not ask candidates to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Candidates often copy values from a question incorrectly. If the examiner thinks that the candidate has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

Premature approximation

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Continental notation

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the candidate intended it to be a decimal point.

Q	Answer	Mark	Comments
1(a)	3500	B1	
1(b)	7	B1	
1(c)	$\frac{1}{5}$	B1	

Q	Answer	Mark	Comments
2	$2 \times 5 + 10 + 2 \times 20 + 2 \times 50 + 2 \times 100$ or 360	M1	oe in £
	Their 360 ÷ 3 or 120	M1	oe in £
	£1 20p 50p 50p 20p £1 10p 5p 5p	A1	SC2 2 totals the same (other than £1.20) with the correct number of coins for all three persons SC1 2 totals the same (other than £1.20) with the correct number of coins for those 2 persons but not the third person
	Additional Guidance		
	Condone eg (£) 0.20p as 20p		
	If a coin is used more than once (eg 10p used twice), a candidate could still achieve M2 or SC1		
	At least 2 persons given £1.20 but not using the correct coins implies M2		
	One person given £1.20 and the other two persons blank implies 120p		M1 M1 A0
	A: £1 20p B: £1 20p C: 50p 50p 10p 5p 5p		M1 M1 A0
	A: £1 10p B: £1 5p 5p C: 50p 50p 20p 20p		SC2
A: £1 10p B: £1 5p 5p C: blank		SC1	
A: £1 5p B: £1 5p C: 50p 50p 20p 20p 10p		(B should have 3 coins) M0 M0 A0	

Q	Answer	Mark	Comments
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3		B3	B1 Each correct answer Accept any indication	
	Additional Guidance			
	Two arrows from the same event is choice and scores B0 for that event (though the candidate may still score if other events are correct)		is B0 (for that event)	
	Two arrows to the same chance may score a mark if one of the arrows is correct			

4	15.05 or 15	M1		
	15.05 and 15 and A	A1		
	Additional Guidance			
	Both calculations must be correctly evaluated to gain the A mark			
	An answer of 'A' with no working scores 0			M0 A0
	If both values are correct and A chosen, ignore further working and explanation			
	Allow 15.05 on the answer line for A			
	Allow $15\frac{1}{20}$ or $15\frac{5}{100}$ for 15.05 for M1 A1 Allow $\frac{301}{20}$ for 15.05 for M1 A0 only unless 15 is written as $\frac{300}{20}$ (in which case M1 A1 can be awarded for a correct decision)			

Q	Answer	Mark	Comments		
5	$\frac{73}{100}$ or 0.73 or 73%	B3	oe fraction, decimal or percentage B1 each correct answer SC1 73 and 39 and 21 with no or consistently incorrect denominators		
	$\frac{39}{100}$ or 0.39 or 39%				
	$\frac{21}{100}$ or 0.21 or 21%				
	Additional Guidance				
	Withhold the mark for 'in' or 'out of' on the first occasion only				
	Ignore descriptive words such as 'likely', 'unlikely', etc				
	73 : 100 and 39 : 100 and 21 : 100		SC1		
6(a)	$2n - 1$	B1			
6(b)	$4n$	B1			
6(c)	Indicates any value of n for which $2n + 1$ is not prime	B1	eg $n = 0$ ($2n + 1 = 1$) $n = 4$ ($2n + 1 = 9$) $n = 7$ ($2n + 1 = 15$) etc		
	Additional Guidance				
	n must be zero or a positive integer				
	Although the value of $2n + 1$ does not have to be evaluated, withhold the mark if an incorrect evaluation is shown eg answer 4 with $24 + 1 = 25$			B0	
	Allow the value of n or the evaluation of the expression (with working shown) on the answer line eg $2 \times 7 + 1 = 15$ followed by 7 or 15 on the answer line			B1	
Check the working, eg $2 \times 3 + 1 = 7$ followed by 7 on the answer line		B0			

Q	Answer	Mark	Comments
7	$40 \div 5$ oe or 8 or $\frac{8}{40}$	M1	
	150 – their 8×3 or $150 - 24$ or 126	M1	
	Their $126 \div 7$ or 18 or $18 \times 7 = 126$	M1dep	dep on M1 M1
	14	A1	
8(a)	64	B1	
8(b)	21	B1	

Q	Answer	Mark	Comments																																																
*8(c)	Alternative method 1																																																		
	$\sqrt[3]{10\,648}$ or 22 or $22^3 = 10\,648$	M1																																																	
	$46^3 = 97\,336$ or $47^3 = 103\,823$	M1																																																	
	22 or $22^3 (= 10\,648)$ and $46^3 = 97\,336$ and $47^3 = 103\,823$ and $46 - 21 = 25$ oe or $47 - 22 = 25$ oe or shows all correct values from 23^3 to 45^3	Q1	Strand (ii) Correct method and values Evaluation is not necessary but if done must be correct SC1 Any 5 correct cube numbers from 12 167 to 97 336																																																
	Alternative method 2																																																		
	$\sqrt[3]{10\,648}$ or 22	M1																																																	
	$\sqrt[3]{99\,999} = 46(\dots)$	M1																																																	
	22 or $22^3 (= 10\,648)$ and $\sqrt[3]{99\,999} = 46(\dots)$ $46 - 21 = 25$ oe or $47 - 22 = 25$ oe	Q1	Strand (ii) SC1 Any 5 correct cube numbers from 12 167 to 97 336																																																
	Additional Guidance																																																		
	The other cube values are: <table border="1" data-bbox="264 1565 1300 1890" style="width: 100%; border-collapse: collapse; text-align: center;"> <tbody> <tr> <td>23</td><td>12 167</td><td>29</td><td>24 389</td><td>35</td><td>42 875</td><td>41</td><td>68 921</td></tr> <tr> <td>24</td><td>13 824</td><td>30</td><td>27 000</td><td>36</td><td>46 656</td><td>42</td><td>74 088</td></tr> <tr> <td>25</td><td>15 625</td><td>31</td><td>29 791</td><td>37</td><td>50 653</td><td>43</td><td>79 507</td></tr> <tr> <td>26</td><td>17 576</td><td>32</td><td>32 768</td><td>38</td><td>54 872</td><td>44</td><td>85 184</td></tr> <tr> <td>27</td><td>19 683</td><td>33</td><td>35 937</td><td>39</td><td>59 319</td><td>45</td><td>91 125</td></tr> <tr> <td>28</td><td>21 952</td><td>34</td><td>39 304</td><td>40</td><td>64 000</td><td></td><td></td></tr> </tbody> </table>			23	12 167	29	24 389	35	42 875	41	68 921	24	13 824	30	27 000	36	46 656	42	74 088	25	15 625	31	29 791	37	50 653	43	79 507	26	17 576	32	32 768	38	54 872	44	85 184	27	19 683	33	35 937	39	59 319	45	91 125	28	21 952	34	39 304	40	64 000		
23	12 167	29	24 389	35	42 875	41	68 921																																												
24	13 824	30	27 000	36	46 656	42	74 088																																												
25	15 625	31	29 791	37	50 653	43	79 507																																												
26	17 576	32	32 768	38	54 872	44	85 184																																												
27	19 683	33	35 937	39	59 319	45	91 125																																												
28	21 952	34	39 304	40	64 000																																														

Q	Answer	Mark	Comments	
*9	0.2×140 or 28 or 1.2 seen or $\frac{1}{4} \times 220$ or 55 or $\frac{3}{4}$ seen	M1	oe	
	140 + their 28 or 1.2×140 or 168 or 220 – their 55 or $\frac{3}{4} \times 220$ or 165	M1	oe	
	168 and 165	A1		
	168 and 165 and (Box) A	Q1ft	Strand (iii) ft their 168 and 165 provided all methods correct	
	Additional Guidance			
	28 or 55 will score at least M1			
	168 or 165 will score at least M2			
	168 and 165 will score at least M2 A1			
	168 and 165 and Box A will score all the marks			
	The Qft mark can only be awarded if both methods for increasing 140 by 20% and decreasing 220 by 1/4 are complete and correct			

Q	Answer	Mark	Comments
10(a)	$x(x - 2)$	B1	
	Additional Guidance		
	Allow the following for B1: $(x)(x - 2)$ $(x - 2)x$ or $(x - 2)(x)$ $(x - 0)(x - 2)$ or $(x + 0)(x - 2)$ or $(x - 2)(x - 0)$ or $(x - 2)(x + 0)$		
	Allow the use of a multiplication sign between the terms in any acceptable answer, eg $x \times (x - 2)$ or $(x) \times (x - 2)$ or $(x - 2) \times x$ or $(x - 0) \times (x - 2)$ etc		B1
10(b)	$(10 - 2x =) 6 \times 3$ or $(10 - 2x =) 18$	M1	oe
	$-2x = \text{their } 18 - 10$ or $-2x = 8$ or $2x = -(\text{their } 18 - 10)$ or $2x = -8$	M1	oe Rearranging to give the x term on one side and number terms on the other
	- 4	A1ft	ft M1 M0 or M0 M1 with one arithmetic or rearrangement error
	Additional Guidance		
	$10 - 2x = 24$ $2x = -14$ $x = -7$	M0 M1 A1ft	
	$10 - 2x = 21$ $2x = 10 - 21$ $x = 5.5$ (should be -5.5)	M0 M1 A0ft	
$10 - 2x = 9$ $2x = -1$ (should be $2x = 1$) $x = -0.5$	M0 M0 A0ft		

Q	Answer	Mark	Comments
11	Reference to a large number of trials eg roll the dice 60 times	B1	Accept 'lots' or a number of trials ≥ 30
	Reference to theoretical probability or Works out the expected frequency for each number	B1	eg (if it's fair) the probability for each number should be $\frac{1}{6}$ eg (if it's fair) it should be (approximately) the same frequency for each number
	Additional Guidance		
	For second B1, ignore incorrect divisions by 6 if wording attracts the mark		
	Examples of reference to a large number of trials:		
	Roll the dice 60 times		B1
	Keep on rolling the dice		B1
	Roll the dice again and again		B1
	Roll the dice numerous times / multiple times		B1
	Roll the dice a number of times		B0
	Reference to theoretical probability or expected frequency:		
	For 60 rolls it should land on 1 (approximately) 10 times		B1
	It should be about the same (relative) frequency for each number		B1
	If it keeps on landing on one number (more than others) it is biased		B1
	It should land on each number (roughly) the same amount		B1
	Roll it 6 times; each number should come up once		B1
	Compare the results to see if it landed on one number more than another		B1
You can work out the relative frequency to see if it's fair		B0	

Q	Answer	Mark	Comments
12(a)	8	B1	
	Additional Guidance		
	Do not accept $\times 8$		B0
12(b)	$3a + 6$ or $6 + 3a$ or $4a - 32$ or $-32 + 4a$	M1	$7a$ or -26 in final answer implies M1
	$7a - 26$ or $-26 + 7a$	A1	
	Additional Guidance		
	$7a + -26$		M1 A0
	$7(a - 6)$ with no previous correct working		M0 A0
12(c)	$r = \frac{p}{w}$ or $\frac{p}{w} = r$	B1	
	Additional Guidance		
	Accept $r = p \div w$		B1
13(a)	D	B1	
13(b)	Any 8 squares shaded	B1	
	Additional Guidance		
	Allow fractions of squares (eg half squares) to be shaded but the total shading must be equivalent to 8 full squares for B1		
14(a)	D	B1	
14(b)	B	B1	

Q	Answer	Mark	Comments
14(c)	x -coordinate > 3.5 and y -coordinate > 6	B1 x -coordinate > 3.5 or y -coordinate > 6 or plots a correct point on the grid but does not give the correct coordinates or draws lines $x = 3.5$ and $y = 6$ or (3.5, 6)	
	Additional Guidance		
	If the answer line is blank and more than one point is plotted on the grid, then all points must be correct for B1		
15	10	B1	
	112	B1	
16(a)	-3 - 5	B1	
16(b)	-1 and 6 or 6 and -1	B1	
17(a)	$32 - 8$ or 24 or $1000 - 8$ or 992 or 32×32	M1	
	1024	A1	SC1 Any multiple of 32 greater than 1000
17(b)	62 and 16 in that order	B1	

Q	Answer	Mark	Comments
18(a)	33 or 24	M1	
	($F =$) 9	A1	
18(b)	$12a - 4a (= 4b)$ or $8a (= 4b)$ or Substitutes values into $P = 4a + 4b$ for P and a such that $P = 12a$	M1	eg $24 = 8 + 4b$ (from $a = 2$ and $P = 24$)
	1 : 2	A1	oe SC1 2 : 1 oe
	Additional Guidance		
	Allow letters in the final answer, for example:		
	$2a : 4a$		M1 A1
	$2P : P$		SC1
19(a)	8	B1	
19(b)	$2 - (3 + 4) + 5 = 0$	B1	Ignore superfluous brackets
	$(1 + 3) \times 5 + 7 = 27$	B1	
	$(1 + 2) \times (3 + 4) = 21$	B1	

Q	Answer	Mark	Comments
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20(a)	All the marbles are red	B1	oe
	Additional Guidance		
	There are no other colours		B1
	It's full of red marbles		B1
	You are certain to pick a red marble		B1
	All the green and blue marbles have been taken out		B1
	There is only 1 marble in the bag (and it is red)		B0
	The bag contains red marbles		B0
	There's a lot of red marbles in the bag		B0
	Most are red because it's certain		B0
	All are red which makes it likely to pick one		B0

20(b)	There might not be the same number of each colour	B1	oe
	Additional Guidance		
	There might be an odd number of marbles in the bag		B1
	She doesn't know how many of each colour are in the bag		B1
	She doesn't know how many marbles are in the bag		B0
	She hasn't included the green marbles		B0

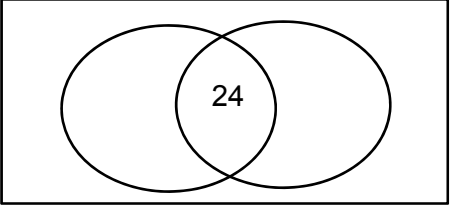
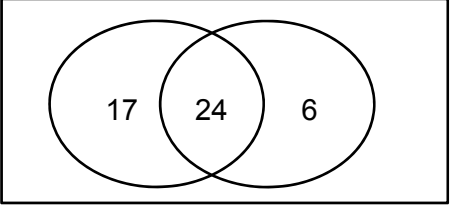
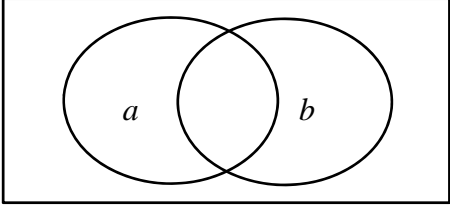
Q	Answer	Mark	Comments
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20(c)	The probabilities do not add up to 1	B1	oe	
	Additional Guidance			
	Ignore calculation errors if it is stated that the sum of the probabilities does not equal 1 or 100%			
	Green should be 0.5		B1	
	The probabilities add up to 1.1 (not 1)		B1	
	The probabilities add up to 0.8 not 1		B1	
	The probabilities don't add up to a whole (one)		B1	
	The probabilities don't add up to a whole number		B0	

21	$60 \div 400 (\times 100)$ or $0.15 (\times 100)$ or $60 \div 4$ or $\frac{3}{20}$ or equivalent fraction	M1	$\frac{60}{400}$ or $\frac{30}{200}$ or $\frac{15}{100}$
	15	A1	

Q	Answer	Mark	Comments																							
22	Correct coordinates worked out for at least two points with at most two incorrect points	M1	May be given in a table																							
	At least two correct points plotted with at most one incorrect point	M1																								
	Correct ruled line from $(-1, -6)$ to $(4, 14)$	A1	SC1 An incorrect straight line drawn with gradient 4 or y-intercept -2																							
	Additional Guidance																									
	The correct line seen scores M1 M1 A1 (irrespective of the points plotted)																									
	For the first M mark: coordinates can be given as embedded values the mark can be implied by the plotted points																									
Table of values: <table border="1" data-bbox="245 1088 1273 1229" style="width: 100%; border-collapse: collapse; text-align: center;"> <tbody> <tr> <td style="padding: 2px;">x</td> <td style="padding: 2px;">-1</td> <td style="padding: 2px;">-0.5</td> <td style="padding: 2px;">0</td> <td style="padding: 2px;">0.5</td> <td style="padding: 2px;">1</td> <td style="padding: 2px;">1.5</td> <td style="padding: 2px;">2</td> <td style="padding: 2px;">2.5</td> <td style="padding: 2px;">3</td> <td style="padding: 2px;">3.5</td> <td style="padding: 2px;">4</td> </tr> <tr> <td style="padding: 2px;">y</td> <td style="padding: 2px;">-6</td> <td style="padding: 2px;">-4</td> <td style="padding: 2px;">-2</td> <td style="padding: 2px;">0</td> <td style="padding: 2px;">2</td> <td style="padding: 2px;">4</td> <td style="padding: 2px;">6</td> <td style="padding: 2px;">8</td> <td style="padding: 2px;">10</td> <td style="padding: 2px;">12</td> <td style="padding: 2px;">14</td> </tr> </tbody> </table>			x	-1	-0.5	0	0.5	1	1.5	2	2.5	3	3.5	4	y	-6	-4	-2	0	2	4	6	8	10	12	14
x	-1	-0.5	0	0.5	1	1.5	2	2.5	3	3.5	4															
y	-6	-4	-2	0	2	4	6	8	10	12	14															
23	$300 \div (1 + 5)$ or $300 \div 6$ or 50	M1																								
	250	A1																								
	Additional Guidance																									
	50 : 250 or 250 : 50			M1A0																						

Q	Answer	Mark	Comments
24	Alternative method 1		
	$\frac{3 \times 8 + 1}{8}$ or $\frac{25}{8}$	M1	Conversion to a fraction
	$\frac{\text{their } 25}{2 \times 8}$ or $\frac{\text{their } 25}{16}$ or $\frac{25}{16}$	M1	oe must be a fraction or mixed number, but condone decimal numerators
	$1 \frac{9}{16}$	A1	oe mixed number SC2 1.5625
	Alternative method 2		
	$1 \frac{1}{2}$ and $\frac{1}{16}$	M1	oe
	$\frac{24}{16} + \frac{1}{16}$ or $\frac{25}{16}$	M1	oe must have a common denominator
	$1 \frac{9}{16}$	A1	oe mixed number SC2 1.5625
	Additional Guidance		
	$1.5 \frac{1}{16}$		M1
	$1 \frac{4.5}{8}$ or $\frac{12.5}{8}$		M1 M1
<p>In alt 1, for the 2nd mark a fraction in the form $\frac{m}{n}$ should become $\frac{m}{2n}$ or $\frac{m/2}{n}$</p> <p>where $\frac{m}{2}$ can be a decimal</p>			

Q	Answer	Mark	Comments
25	$30 \div 5 \times 4$ or 24	M1	
	Their 24 + 23 or 47 or sum of two outer parts of circles is 23	M1	  $a + b = 23$
	50 – their 47 or 50 – their 17 – their 24 – their 6 or 3	M1dep	dep on M1 M1
	$\frac{3}{50}$	A1	oe fraction, decimal or percentage 0.06 6%

Q	Answer	Mark	Comments
26	$54x^8$	B2	B1 54 or x^8
	Additional Guidance		
	Ignore a multiplication sign between 54 and x^8 but not any other sign		
	$54 \times x^8$ or $x^8 \times 54$	B2	
	Condone $x^8 54$	B2	
	$54x^{15}$ or $15x^8$ or $15 \times x^8$	B1	
$54 + x^8$ or $54 + x^{15}$ or $15 + x^8$ or 54^8	B0		